THE ORIGIN OF THE ANCIENT EGYPTIAN CALENDAR

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ABSTRACT

In 1904 Eduard Meyer stated that the Egyptian calendar was invented about 4231 B.C., and some of the principal Egyptologists of his generation adopted this theory with minor modifications. In recent years it has been realized that 4231 B.C. was far back in the prehistoric period, long before the invention of writing, and of necessity later dates have had to be advanced for the adoption of the calendar as we know it.

Primitive man in Egypt regulated his life entirely by the cycle of the Nile's stages. Nature divided his year into three well-defined seasons—Flood, Spring, and Low Water or Harvest, with the Flood Season, following the hardship of the Low Nile, the obvious starting point for each annual cycle. The Egyptian early recognized the fact that usually twelve moons would complete a Nile year, but his lunar reckoning always remained secondary to his Nile reckoning, and he never adopted solar seasons. However, by about 3200 B.C. he probably recognized the heliacal rising of the prominent star Sothis as a definite phenomenon heralding the coming flood, and he began to count the observed reappearance of the star as his New Year Day. His year he now adjusted to twelve artificial moons of 30 days each, followed by about five days in which he awaited the reappearance of Sothis.

For several centuries the calendar was fixed to the star and thus was approximately correct, but the experience of generations was apparently proving that the perfect year should be 365 days long, and in 2773 B.C. a year of this length was adopted, by the simple expedient of neglecting to readjust the calendar by annual observations. Since no change was ever permitted thereafter, the Egyptian calendar was only correct once in every 1460 years.

THE calendar of the ancient Egyptians was one of man's earliest experiments in almanac making. Certainly it was one of his most enduring, for in the first centuries of the Christian era it was still being used much as it had been during the pyramid age three thousand years earlier. This uninterrupted existence throughout more than half of man's recorded history has given it an almost mysterious quality which has been so intriguing to modern scholars that within my own memory—and even within this last year or so—many an article on its origin has appeared, all differing more or less fundamentally in the story they strive to reconstruct.

The approach to this problem has usually started with a statement made by Censorinus in 238 A.D. to the effect that the Egyptian New Year Day in 139 A.D. fell on July 21, when the bright star Sothis—which we know as Sirius—after having been invisible for

a season, made its annual reappearance in the eastern sky just before sunrise. Since the Egyptian civil year was one of 365 days and that of Sothis was one of 365¼ days, this coincidence could only have happened at intervals of about 4 × 365 years, or in 1317, 2773, and 4231 B.C.[1] Believing that the ancient Egyptian calendar could only have been invented on one of these occasions of coincidence, and further believing that 2773 B.C. fell in the Fourth Dynasty when the calendar was already in use, Eduard Meyer stated in 1904 that the calendar must have been introduced in 4231 B.C.[2] Eventually Meyer concluded that it was not until 3200 B.C. that Menes, the first historical king of Egypt, united the Two Lands,[3] yet he never altered his date for the invention of the calendar, which would thus have been in uninterrupted use for a thousand years before the beginning of Egyptian history—and equally long, we now suppose, before the development of writing. James Henry Breasted[4] accepted Meyer's theory that the invention of the calendar in 4231 B.C. was "the oldest fixed date in history." Evidently realizing the difficulties which this involved, Breasted eventually attributed the invention of the calendar to a predynastic "First Union" of the Two Lands, which, while it is supposed to have taken place in the forty-third century B.C. and to have lasted for eight hundred years,[5] has left no written document nor any other tangible trace in history. Eventually Ludwig Borchardt[6] gave Meyer's theory a momentary support by his

[1] The dates of the so-called "Sothic periods," as given by different historians, vary slightly among themselves. Here, as in the following pages, they are uniformly made to agree with the latest corrected tables by P. V. Neugebauer in *Astronomische Nachrichten*, v. 261, no. 6261, 1937. I owe this reference to the kindness of Otto Neugebauer—who is not to be confused with his namesake, the compiler of the tables.

[2] *Aegyptische Chronologie* (*Philosophische und historische Abhandlungen der Königlich preussischen Akademie der Wissenschaften*, 1904), p. 41; and (in the same *Abhandlungen* for 1907) *Nachträge zur ägyptischen Chronologie*. In the following pages the references will be cited as Meyer, *Chron.*, or Meyer, *Nachtr.* In 1913 he repeated the thesis in his *Geschichte des Altertums* (3rd edition), § 159.

[3] *Die Ältere Chronologie . . . Ägyptens, Nachtrag zum ersten Bande der Geschichte des Altertums* (1931), p. 68; referred to below as Meyer, *Ältere Chron.* This 1931 edition appeared after Meyer's death, and a note by the editor, H. E. Stier, on page 74, calls attention to Alexander Scharff's recent theory that the calendar was invented in 2773 B.C.

[4] *Ancient Records*, I, pp. 25 ff.; *A History of Egypt*, pp. 32, 44.

[5] "The Predynastic Union of Egypt," *Bulletin de l'Institut français d'archéologie orientale*, XXX (1930), p. 709; *Ancient Times* (2nd edition, 1935), pp. 54, 58. He appears to have been led into this idea partly by one of Sethe's brilliant and seemingly plausible philological exercises, *Der ægyptischen Ausdrücke für rechts und links*, and also by Sethe's *Urgeschichte und älteste Religion der Ägypter*.

[6] *Die Annalen und die zeitliche Festlegung des alten Reiches* (*Quellen und Forschungen zur Zeitbestimmung der Ägyptischen Geschichte*, Band 1), p. 30. Borchardt's chronology was strongly criticized by Peet, *Journal of Egyptian Archæology*, vol. VI (1920), pp.

attempt to place Menes close to Meyer's date for the invention of the calendar. This combination appealed to Kurt Sethe whose study of the origin of the calendar,[7] while unsatisfactory in its conclusions, is a most valuable compendium of all the available material.

In recent years the various modifications of Meyer's theory have been less generally accepted than formerly, and the tendency has been toward the more reasonable hypothesis that the calendar was a product of some later period.

One of the most recent and most ingenious schemes for avoiding this difficulty—but one which unhappily was inspired, I understand, by tempting but false etymologies for the Egyptian season names—was propounded last year by Professor Jotham Johnson of the University of Pittsburg.[8] He argued that the primitive Egyptian had a lunar calendar until the morning of June 18, 3251 B.C. when Sothis appeared over the eastern horizon just before the dawn of a day on which the new moon occurred. From that day onward the calendar was fixed to Sothis, but gradually the calendar became so far divorced from the terrestrial seasons that it had to be corrected by exactly one whole four-month season on June 18, 2773 B.C.—after which it became the wandering year of the historic period.

Alexander Scharff of the University of Munich had long seen the difficulties inherent in Meyer's theory, and in 1927 [9] he had stated that the calendar must have been invented in 2773 B.C.—a whole Sothic period later than had usually been proposed. Before that date he assumed that the Egyptian reckoned time by some wholly different system, which he did not exactly define but which in one place he seems to say was based on a year of 320 days.

149 ff., and by Meyer, *Ältere Chron.*, p. 41, but Borchardt modified it only very slightly in *Quellen*, Band 2, *Die Mittel zur zeitlichen Festlegung von Punkten der Ägyptischen Geschichte* (Kairo, Selbstverlag, 1935). So far as this refers to the XVIII Dyn., it is analyzed—unfavorably—by W. F. Edgerton in *American Journal of Semitic Languages*, LIII (1937), pp. 188 ff. In both parts, although Borchardt's conclusions are unsatisfactory, he makes a great deal of important material available, but I have a feeling that the complexity with which he treats the subject would have made the ancient Egyptian's head spin. References below will be to Borchardt, *Quellen*.

[7] *Die Zeitrechnung der alten Aegypter*, in the *Nachrichten der K. Gesellschaft der Wissenschaften zu Göttingen, Philologisch-historische Klasse*, 1919–1920. It will be quoted below simply as Sethe, with the pagination of the *Nachrichten*, in which pages 287–320 are of 1919, and pages 28–55 and 97–141 are of 1920.

[8] *Journal of the American Oriental Society*, **59** (1939), p. 403.

[9] *Grundzüge der ägyptischen Vorgeschichte*, p. 54, in *Morgenland; Darstellungen aus Geschichte und Kultur des Ostens*, Heft 12. See note 35 below.

Two years ago Otto Neugebauer,[10] now at Brown University, came out with an extremely intriguing and still more revolutionary theory. He stated that if the primitive Egyptian kept records of the days which elapsed between the successive inundations of the Nile over a period not exceeding fifty years, an average of these periods would infallibly lead to a 365 day year without the observation of any heavenly body whatever. This is unquestionably true in the light of our present day knowledge, but it is doubtful whether it was equally obvious to the Egyptian in the stone age.[11] The figures which Neugebauer himself uses give differences in the lengths of the intervals between floods of as much as 80 days in a single generation, and come to exactly 365 days only once in that period.[12] When one Nile year might be only 335 days long and another as much as 415, it is a question whether primitive man would ever, unaided, have arrived at the conception of an average Nile year or would have known how to calculate it, had he thought of it. Setting a calendar by the Nile flood would be about as vague a business as if we set our calendar by the return of the Spring violets. However, Neugebauer's very interesting theory appealed to Scharff as supplying evidence on the nature of the Egyptian calendar before 2773 B.C.—and perhaps even as late as 2000 B.C.—and he now enthusiastically endorses it in part, even if not in all its details.[13]

Before examining the problem of the origin of the calendar afresh a digression appears to be justified on a matter which, even recently, has been the subject of discussions likely to complicate the whole question in the minds of some readers.

[10] "Die Bedeutungslosigkeit der 'Sothisperiode' für die älteste ägyptische Chronologie," in *Acta Orientalia*, XVII (1938), pp. 169 ff. In briefer form, with additional remarks by Jean Capart, in *Chronique d'Égypte*, No. 28, July, 1939, pp. 258 ff.

[11] This would require not only a count of the days between successive floods, but a Nilometer, sufficiently massive to withstand the erosion of the inundations, on which comparable stages of the Nile might be measured. Sethe (*Urgeschichte und älteste Religion der Ägypter*, §§ 109 ff.) believed that there was such a Nilometer on the Island of Roda near Memphis, as early as prehistoric times. This is pure hypothesis, as is recognized by Scharff on p. 9 of the article cited in note 13 below.

[12] He uses the figures given by Sir William Willcocks for 1873–1904, before the completion of the Aswān dam. They were doubtless typical of the years before the Nile was artificially controlled. Borchardt (*Quellen*, I, p. 7) uses a non-continuous series of 32 high Niles between 1798 and 1888, which give comparable results.

[13] *Die Bedeutungslosigkeit der sogennanten ältesten Datums der Weltgeschichte*, read to the Phil.-hist. Abteilung der bayerischen Akademie der Wissenschaften zu München in July, 1939, and (in summary) to the Archæological Congress in Berlin in August, 1939, and published in the *Historische Zeitschrift*, **161**, pp. 3 ff. Scharff seems to approve most of Neugebauer's theory except that (pp. 15, 18) he hesitates to accept a 365 day year as early as the I-II Dyns. See note 35 below.

In modern studies on the historic Egyptian calendar one sometimes reads of a "civil" or "wandering year" and of a co-existent "fixed year" by which festivals might be kept in unvarying relation to the more or less true solar seasons of the inundation, agriculture, and the important reappearance of Sothis.[14] It may be as well at the outset of this paper to state that the ancient Egyptians, from the Old Kingdom to the Roman Period, have not left a single trace of such a fixed calendar. Out of the thousands which have survived from dynastic Egypt, not one document gives equivalent dates in the known "wandering" year and the hypothetical "fixed" year. Furthermore, by the time that relations with the outside world were such as to result in unprejudiced foreign evidence on the customs of Egypt, we find the Egyptian both ignorant of, and unreceptive to the idea.

About 600 B.C.,[15] Thales of Miletus introduced the Egyptian year of 365 days to the Greeks, without hint of any correction being required, and Herodotus, when he was in Egypt about 460 B.C., heard only of a 365 day year and was under the impression that it was not only an accurate measure of time, but that it was the only accurate year devised by any contemporary people. When in 488 B.C. Darius adopted the Egyptian calendar for Persia, it was as an unmodified 365 day year, and after 120 years a whole month had to be intercalated to correct the Persian calendar. The credit for the discovery that a solar year consisted of 365¼ days was given by classical authors to Eudoxos of Knidus (408–355 B.C.) whose calculations were probably those used by the Macedonian Ptolemy III Euergetes when, by the Canopic Decree of 237 B.C., he attempted to introduce a 365¼ day year in Egypt.[16] In that decree

[14] Sethe, pp. 311 ff., "Das feste Jahr." Meyer (*Chron.*, pp. 31 ff., "Das angebliche feste Jahr,") unanswerably refutes some of the arguments current before the appearance of Sethe's *Zeitrechnung*.

[15] The following paragraph is largely drawn from Sethe, pp. 315–318.

[16] Meyer, *Chron.*, p. 31; translation in J. P. Mahaffy, *A History of Egypt under the Ptolemaic Dynasty* (1899), pp. 111 ff., and in Edwyn Bevan, *A History of Egypt under the Ptolemaic Dynasty* (1927), pp. 207 ff. The decree is definite proof that a fixed calendar was unknown to the Egyptians in the III Cent. B.C. It is dated March 6, 237 B.C., when the flood and the reappearance of Sothis were expected to take place on the last of the Month *Payni* (95 days before New Year Day) and is an attempt to fix the calendar unalterably to the seasons as they were in that year, inconvenient though they would seem to be. It provides that an intercalary day be added, in every fourth year, to the five festivals of the gods at the end of the year, "in order that it may not occur that some of the national feasts kept in winter may come in time to be kept in summer . . . as has formerly happened." Furthermore, in order that Ptolemy Euergetes should always be credited with correcting "the former defect in the arrangement of the seasons," it provides that this sixth god's festival shall be named for the Benefactor Gods—Ptolemy and his wife, Arsinoe.

no reference is made to the idea being native to Egypt, and in fact it appears to have been regarded by the Egyptian people as an abhorrent foreign innovation with which they would have absolutely nothing to do, in spite of the fact that it was said to have the sanction of their own priesthood. It was only in 46 B.C. that Sosigenes of Alexandria [17] evolved for Caesar the Julian Year of 365¼ days, and twenty years afterwards Augustus imposed upon Egypt an era of Julian Years, starting with August 1st, 30 B.C., under the name of the Alexandrian year. Even this—called by the Egyptians the "Greek Year" to distinguish it from the year "according to the Egyptians," or "according to the ancients" [18]—was not used by the natives until they had given up their own religion and had adopted Christianity. In short, the whole history of a year with intercalations, as we see it in classical times, is a history of an innovation obnoxiously foreign to the native Egyptian. There is no hint in the whole four centuries and a half covered by the classical literature that the Egyptians had any memory of ever having used a fixed year or ever having recognized its desirability.

The ancient Egyptian calendar of the historical period gives clear evidence that it originated in the climate of the land. Egypt has been, to all intents and purposes, rainless for many thousand years, and all living things in the Nile valley have been dependent on the fluctuations of the river. In the very occasional years when the Nile flood is average, the river is lowest at the First Cataract about the end of May and at the head of the Delta some two weeks or more later. Soon afterwards come the floods from the equatorial rains on the water-shed of the upper Nile during the preceding winter. The river rises slowly at first and then more rapidly, until it reaches its height at the First Cataract about September 1st and a month later at the Delta head where, by the middle or end of October, the highest of the flooded lands begin to emerge once more and the waters fall, until they reach their lowest again the following June.

[17] It was probably Greek mathematicians in Alexandria who told Diodorus (I, 50) in 60–56 B.C. that the Egyptians "reckon . . . their month of 30 days and they add 5¼ days to the 12 months, and in this way fill out the cycle of the year." All other evidence is against such having been the native practise at this time, but the facts were doubtless well known to the Alexandrian Greeks.

[18] Meyer, *Chron.*, p. 32. Otto Neugebauer reminds me of the fact that 200 years after the Julian Calendar reform the astronomer Ptolemy was still performing his calculations in the 365 day Egyptian year. This, however, was merely for convenience—not because of chauvanism. The Julian year is still being used in preference to the Gregorian by astronomers, sometimes to the confusion of archæologists.

During the palæolothic period, whenever the periodical rise of the Nile got under way, the settlements of the primitive Egyptians along the river banks and in the marshes, where they had been established to be near water, would have to be abandoned for others on higher ground. For a space, the Nile people would look down from the desert edge upon a broad lake covering meadows, groves, and swamps, and they would be forced to subsist on fishing, fowling, and hunting. This season in the language of their descendants, the dynastic Egyptians, was *Akhet*—"the Flood." In due course the waters would fall, and the Egyptians would follow the edge of the receding flood across the alluvial plain, pasturing their flocks—once they had domesticated any—on its meadows fast growing green, themselves eating the wild fruits and vegetables which sprang up and ripened in the hot, moist soil, and—when they had learned to save the seed from the last low Nile—strewing it over the wet, black mud where it would sprout and mature very shortly under the cloudless skies. This season in the language of their descendants was *Prōyet*—"the Coming Forth," "the Spring." As the waters descended, man returned to the river and to the permanent swamps where water could be had most easily, and waited for the next flood. This season was called by his descendants *Shōmu*—perhaps meaning at first "the Low Water," but later surely understood as "Harvest-time."[19] Thus the Egyptian recognized but three seasons, and when he adopted a word for "year" he chose a form of the word *ronpy*, "to be young," or "fresh" as of plants, and he considered this year as beginning with the first signs of the rising water which would bring out the verdure once more. These first signs of the awaited flood would be such as primitive hunters and fishermen might learn. First the waters would turn green from the algæ floating down from the swamps of the upper Nile, and the green water would last until the flood was definitely under way. The river itself and the river animals, the hippopotami, crocodiles, and fish whose actions foretold the coming flood, must have been the first harbingers of another cycle of seasons to primitive man. At this stage in his

[19] Sethe, p. 294; Alan H. Gardiner, *Egyptian Grammar*, p. 203. The word *Shōmu* seems to be derived from two words meaning "deficiency" of "water." Later it acquires two meanings: (1) the season of low water, and (2) the harvest. Usually its "determinative" differs with the meaning, but an XVIII Dyn. ostracon found by the Metropolitan Museum's Expedition (and shortly to be published by W. C. Hayes, *Ostraca and Name Stones from the Tomb of Sen-Mūt*, No. 106) writes the word in a date with both determinatives.

development he probably could not count beyond the number of his fingers and surely was not interested in predictions beyond the immediate future.

By the time stone-age man first felt the need of some other means of predicting the future stages of the river—probably as agriculture became his chief interest—he must already have become accustomed to counting the phases of the moon. He would early have realized that once the Nile is rising, some four moons must pass before he could sow his seed corn on the emerging mud; how at least four moons again would be required for the grain to ripen; and how a third four moons would pass before the flood would reappear again. Of course, even in the ideally normal year such a count would be only approximate. We know that each moon is theoretically about 29½ days, and twelve moons only 354 days, and that therefore in three successive floods—aside from the irregularities of the river itself—an error of a little more than a moon would have occurred. However, the ideal flood occurs perhaps only once in a generation, and year after year the actual period between one low Nile and the next might be anywhere between 11 and 14 moons. An early or a late flood would sometimes make such a moon reckoning correct, sometimes wrong, but to primitive man the moon still would serve as a ready rule of thumb for predicting the seasons. And after all, the coming of the flood was the start of the new year, regardless of the moon count.

Long after he had evolved a far more practical calendar, the Egyptian still retained some memories of his primitive lunar reckoning. It gave him his subdivision of the year into twelve parts, and the moon gave its name *abod* to each of those parts, as it has to our "months." About 1850 B.C. lunar months, alternately 29 and 30 days long and totally unrelated to the then current civil calendar, still served to set the periods of priestly temple service.[20] From then down to Roman times there seem to be traces of lunar months in religious calendars, and it would appear that the coronations of the kings were supposed to take place on the day of the full moon.[21] In 1100 B.C. astronomical tables still had a technical term for the mid-month which appears to go back to a time when a month was literally a moon and the mid-month

[20] Meyer, *Chron.*, p. 52; Sethe, p. 301.

[21] Borchardt, *Quellen*, II, pp. 39 ff., 69 ff. This theory is approved by Edgerton, *Amer. Jour. of Semitic Languages*, LIII (1937), pp. 188 ff. He quotes, however, Černý, *Ägyptische Zeitschrift*, LXXII (1936), pp. 109–118, for an emergency at the death of Ramesses III which caused his successor, Ramesses IV, to be installed immediately.

was full moon time.[22] Even in Pliny's [23] time it was a popular by-word that the flood might be expected on the new moon next after the summer solstice, and Vettius Valens,[24] probably through some misunderstanding of a similar popular saying, supposed that the New Year was on the new moon preceding the reappearance of Sothis.

However, lunar reckoning was always of secondary importance to the Egyptian. Those whose calendars are lunar count the start of each day from sunset, when the new moon, the new month, and the new year all take their beginning.[25] The Egyptians, on the contrary, alone of all ancient peoples, commenced their day at dawn,[26] and when their writing was invented the same ideogram stood for both the words "sun" and "day."

Nevertheless, the Egyptian never adopted solar seasons. His seasons were always those of the Nile, whose rise and fall, originating in the distant and unknown south, the prehistoric Egyptian could have had little or no reason to associate with the sun. Only during a brief period in the fourteenth century B.C. did Egyptian beliefs give full credit to the Sun for its controlling influence on terrestrial life.[27] But even then the relationship of the Sun to the phases of the Nile was not clearly understood, and it was apparently only in classical times that the solstice was regarded as an omen of the coming inundation. Thus, about 450 B.C. Herodotus [28] wrote: "the Nile, at the commencement of the Summer Solstice, begins to rise and continues to increase for a hundred days and as soon as that number is passed it forthwith retires and contracts its stream, continuing low during the whole winter until the Summer Solstice comes around again." Later Pliny was told that the river rose at the full moon next after the Summer Solstice, and similar beliefs have been current until modern times.[29]

[22] Sethe, pp. 130, 136.

[23] *Natural History* (ed. Bohn), Book 5, Chapter 10.

[24] Sethe, p. 296.

[25] Sethe, p. 119.

[26] Sethe, pp. 130–138.

[27] Sethe, pp. 28–30. During the reign of Akh-en-Aten (1375–1358 B.C.) the "Hymns to the Sun" attributed to that heavenly body full control over all nature, including the Nile (Breasted, *A History of Egypt*, pp. 371–376; *Development of Religion and Thought in Ancient Egypt*, pp. 312 ff.). However, Sethe (pp. 37 ff.) is wrong in assuming an importance for the winter solstice, which actually seems to have played no part in Egyptian thought.

[28] Book II, 19.

[29] For Pliny, see above, note 23. For recent beliefs, see E. W. Lane, *Manners and Customs of the Modern Egyptians* (1836), II, pp. 254 ff.; Lepsius, *Chronologie*, p. 213.

Here it is important to recall certain fundamental points in our problem. First, the rise of the Nile began the new year. Second, the erratic nature of this event was too variable to be itself a measure of time for a people who were becoming more and more cultivated. Third, the moon had proved only a little better. And fourth, the sun did not seem to the Egyptian to have any connection with the question. Yet there is something in man which makes him look to the heavens for his calendar, and the Egyptian, like all others, turned to the sky for some sign that his new year was approaching.

In the cloudless Egyptian nights one of the most prominent, single, heavenly bodies is the great star Sothis. As is the case with all fixed stars, there is a period in each year when Sothis has disappeared from the night sky, rising and setting in daylight. Then one morning its rising is just sufficiently earlier than the sunrise for it to be seen once more for a short time in the dawn as a prominent feature of the eastern sky. About 7000 B.C. Sothis was visible in the dawn at the head of the Nile Delta around May 21st, which was so long before even an exceptionally early flood that no possible relation could have been seen by any primitive Egyptian between the star and the rising Nile. But since about every 120 years this annual reappearance occurs a day later in the solar year, gradually the star's rising was retarded until, in the latitude of the Delta, it took place just before sunrise on June 17 [30] in 3500 B.C. Very slowly—so slowly that it took generations to make a day's difference—the star's reappearance was delayed further until it came on June 23 about 2800 B.C.—and the later it came the more certain it was to be regarded as a harbinger of the flood.

The reappearance of this brightest of stars in the dawn is a striking sight. It must have been especially so to primitive man suffering in the fiery heat of an Egyptian June, when the Nile was at its lowest, and his longing for the flood was keenest. Gradually he began to associate the return of Sothis with the first stages of that longed-for high Nile which he grew to expect would follow soon afterwards. When it was that man became conscious of this association we shall never know. Obviously it was an idea which took shape slowly.

[30] Throughout Coptic and Arab times, at least, the night of June 17 was celebrated as "the Night of the Drop" when it was believed that a miraculous drop fell into the Nile, causing it to rise. After July 3 the flood was usually obvious enough to be proclaimed daily by criers in the streets of Cairo. Lane, *loc. cit.*

However, it is impossible to doubt the fact that, as early as the dawn of the historic period, the Egyptian was already regarding Sothis as the harbinger of the all important inundation. From one of the royal tombs at Abydos, dating from the first historic Egyptian dynasty, there comes a little ivory tablet which is now in Philadelphia in the University Museum. On it is inscribed a brief and primitive inscription which has been interpreted "Sothis Bringer of the New Year and of the Inundation." [31] Coming to us from a slightly later period—but in all probability repeating the words of a much earlier composition—is a passage in the Pyramid Texts describing Sothis as the creator of all green growing things, and hence of the year itself.[32]

Here we have statements in the very dawn of history naming Sothis, the recognized master of the annual flood, as the creator of the year—by which of course we may understand the calendar.

We need have very little doubt that this association of Sothis with the year was at least as early as about 3200 B.C.—a date which, it must be realized, can only be fixed approximately—when the Egyptian communities were united by Menes, the first King of Upper and Lower Egypt.[33] Menes also is credited with founding the capital city, Memphis, at the head of the Nile Delta, and it is noteworthy that it was the observation of the reappearance of Sothis at Memphis which was regarded as official throughout

[31] University Museum, E 9403; Petrie, *Royal Tombs*, II, pls. V, 1, VIa, 2; Sethe, *Beiträge zur ältesten Geschichte Ägyptens*, p. 63; *Zeitrechnung*, p. 294. Borchardt, who apparently never had laid eyes on the tablet, published retouched photographs of it (*Quellen*, I, p. 53, n. 1), gratuitously adding the hieroglyphic signs for "month 2" in the blank space in its lower right hand corner. Unfortunately for his theory, he had not noticed that the inscription on it is incised, and therefore no part of it could have faded out, as he seems to have assumed. I have examined both the tablet itself and a photograph which I received through the kindness of Dr. Hermann Ranke and can testify that the Petrie publication is accurate. More recently, Scharff has described the tablet (*Ältesten Datums*, p. 14, note 1) as bearing the notation "the year of the cow counting," but this gives no explanation for the hieroglyphic sign *akhet*, of which Sethe takes account.

[32] *Pyramid Texts*, 965 a-b, makes the characteristically punning statement that "It is Sothis, thy beloved daughter, which has made the fresh green ('the New Year offering'—*rnp-wt*) in this thy name of year (*rnp-t*)." Scharff, *Ältesten Datums*, pp. 17–18, 31.

[33] Meyer (*Ältere Chron.*, pp. 68–69) dates Menes, founder of Dyn. I and traditionally of Memphis, to about 3200 B.C., admitting the possibility of an error of as much as 100–200 years either way. Scharff (*Die Altertümer des Vor- und Frühzeit Ägyptens* (1931), pp. 31–32, and *Ältesten Datums*, pp. 21–22) dates Menes to 3000 B.C. However, he seems to approve the recent figures of Farina for the Turin Papyrus, by which the XI Dyn. begins apparently in 2143 B.C. and the I–VIII Dyns. covered 955 years. This gives a minimum date of 3097 B.C. for Menes, without making any allowance for the 18 kings of the IX–X Dyns., except insofar as the X Dyn. may have been contemporary with the first half of the XI Dyn.

Egypt during the historic period.[34] With Menes began the written records of the lengths of the reigns of the kings, expressed in years, months, and days, which later annalists had no difficulty in combining with later records in the composition of the Palermo Stone, the Turin Papyrus, and the History by Manetho. And another, and most important point, each and every year on the Palermo Stone had an inundation, which would not have been the case had the civil year differed markedly from the natural year, as Scharff has suggested.[35]

It must be realized, however, that even when the primitive Egyptian began to recognize the reappearance of Sothis in the dawn as an omen of the coming flood, he had not immediately established what we call a "fixed" calendar. His calendar was without doubt still dependent on an annual observation of Sothis, and a successful observation of the heliacal rising without instruments presents its difficulties. Ludwig Borchardt [36] attempted the observation between 1924 and 1927, with various collaborators stationed up and down the Nile between the latitudes of ancient Thebes and ancient Heliopolis under conditions simulating, as nearly as he could imagine, those of ancient times. Today the reappearance of Sothis is due early in August when a mist often hovers over the inundated valley at dawn, and in addition the modern air is likely to be befogged with chimney smoke. Furthermore, the point of the sunrise on the horizon is nearer to that of

[34] This is a tradition preserved by Olympiodorus (writing in 565 A.D.), who stated that the whole land had followed the Memphite observation for the official date of the heliacal rising of Sothis. *Cf.* Sethe, p. 309. It should be remembered that when Sothis reappeared at Memphis on any given day, its heliacal rising had taken place at Aswān six days earlier.

[35] Scharff (*Gründzuge*, pp. 55–56; *Ältesten Datums*, pp. 15, 18) lays great stress upon the fact that the sum of the months and days in two adjacent regnal year spaces at a change of kings on the front of the Palermo Stone totals only 10 months and 20 days. Hence, he argues that the 365 day year was not in use in the first two dynasties. He can not, however, escape the fact that in a similar place in line 4 on the back of the stone, at the change of reign from Saḥu-Rē' to Nefer-ir-ka-Rē', the total is only 11 months and 13 days, although the 365 day year admittedly existed in the V Dynasty. In these two places where there seem to be intervals between reigns (in the one case of 45 and in the other of 22 days) it is possible that these may be the periods between the death of one king and the coronation of the next, which had to await the presence of the successor in the capital and the occurrence of the full moon. See note 21 above. Further, Scharff forgets that if a year consisted of 320 days only, some years would have no inundation at all.

[36] Ludwig Borchardt and Paul Viktor Neugebauer, *Orientalistische Literaturzeitung*, 1926, cols. 309 ff.; 1927, cols. 441 ff. In the latter article the authors had the collaboration of members of the Egyptian Survey Department. These experiments (among the most enlightening contributions to the study of the Egyptian calendar) prove that primitive observers could have established a 365 day year only after long experience.

the star rise than it was when the latter took place at the solstice, and the star is therefore more difficult to see in the growing dawn. Hence, the modern observers sometimes did not see the star for as many as five mornings after it should have been visible, and while about 3200 B.C. conditions were better, there must have been many a year when the first glimpse of the star was a day or so late—in which case it would probably be a day too early the next year. To this uncertainty of observation another day would have to be added every fourth year as we add the day to our leap years. Indeed, when the primitive Egyptian first began to keep account of the days between heliacal risings he must have been very far from believing in anything like a fixed year.

Since his year was based on a primitive observation which had to be made annually, each New Year was marked with some uncertainty, but for the First Dynasty Egyptian that was surely not as great a drawback as it sounds to us. The Mohammedan months do not begin, even today, in theory, until one of the faithful has actually seen the new moon in the sunset, and I can well remember how once or twice there was a great deal of doubt, while I was still living in Egypt, as to when the month-long fast of Ramadan might be broken.[37] To primitive man a day or so of doubt of this sort would have caused far less bother than it does to his modern peasant descendant, and to him it causes little bother enough.

I suggest, then, that the Egyptian of the time of Menes was starting his year with an observation of the reappearance of Sothis. The divisions of the year were borrowed from prehistoric customs with, however, some important modifications. There were still the three seasons of Flood, Spring, and Harvest—now always of 120 days each. The "moons" were so convenient that they were retained as "months," even when it was found that they could not coincide with Sothis. From now on for civil affairs they were artificially ordered, each of exactly 30 days—or three ten day "weeks"—and between one reappearance of the star and the next there were always twelve months and a few days over. These extra days "Over and above the Year" [38]—which came between

[37] Lane (*Modern Egyptians*, II, p. 229) describes how the observation of moon-rise was made in Cairo a little over 100 years ago.

[38] Sethe (pp. 303 ff.) gives all the existing data on the five intercalary days, but his interpretation—that the year was originally of 360 days only—can hardly be accepted. It fits in, however, with the thesis of Scharff, *Ältesten Datums*, p. 16. The days "Over and above the Year" at first headed the new year (Sethe, *Urkunden des A. R.*, I, pp. 25, 27; Breasted, *Ancient Records*, I, §§ 218, 221); in later calendars they closed the old year.

the last month of the old year and the first of the new, and on which the reappearance of Sothis was to be awaited—were the "Birthdays of the Gods." [39] Usually the heliacal rising came after the fifth of them, and according to the now existing texts, on them the births of five gods of the Osiris cycle were to be celebrated. Sometimes six days would pass before the star's reappearance, and then perhaps the birthday of another god would be celebrated.[40] The next year, or the year after, the star would probably be visible a day before it was expected, in which case the last of the birthdays would be lost for a year. The important thing is that none of the twelve months were ever increased or diminished, and the uncertainty was always confined to these days "Over and above the Year."

I believe this to have been the situation during the first two dynasties. The commencement of each year was dependent on the heliacal rising of Sothis being observed, with the result that while most years might be 365 days long, every fourth year was probably a day longer, and any other year might be a day or two longer or shorter, depending on the accidents of observation. Yet we know that throughout the later historical period the year differed from the star, and also from the ever variable Nile. The problem, therefore, is when was the Egyptian "wandering" year first used.

Throughout the most familiar part of Egyptian history the "civil" year contained only 365 days, with the result that its New Year Day was "wandering" both in respect to the solar seasons and in relation to Sothis as well. As has been mentioned already, the civil New Year coincided with the reappearance of the star in 139 A.D. and hence, we may suppose, in 1317 B.C. From the period between 1317 and 2773 B.C. there are several items of evidence which demonstrate that the civil calendar was consistently "wandering" throughout that period. From the Eighteenth Dynasty we have calendrical dates for the reappearance of Sothis in 1469 B.C., as recorded in the Elephantine Festival Calendar of Tḥutmose III,[41] and in 1545 B.C. in the calendar of the Ebers Papyrus

[39] Sethe, *Die altaegyptischen Pyramidentexte*, par. 1961 c; only in the pyramid of Nefer-ka-Rē' (Pepy II). See also Meyer, *Chron.*, p. 40; Scharff, *Grundzüge*, p. 56. Scharff (*Ältesten Datums*, p. 17) states that this passage, while of the Old Kingdom, is not very ancient.

[40] In the attempted calendar reform of Ptolemy III Euergetes (see above, note 16) the extra day in every fourth year was to be dedicated to Euergetes and Arsinoe in their divine quality.

[41] Sethe, *Urkunden der 18. Dynastie*, p. 827. The calendar is for an unrecorded year in the reign of Tḥut-mosĕ III when the reappearance of Sothis took place on the 3rd

of the reign of Amen-ḥotpe I.[42] In the Twelfth Dynasty the Kahun Temple Day Book of 1877 B.C. fixes the date for that year,[43] and in the Eleventh Dynasty the dekan tables symbolizing the heavens on the lids of coffins give dates for the reappearance of Sothis between 2101 and 2021 B.C., which are absolutely consistent with the later dates for the same event.[44] Naturally, as we go further back through the Old Kingdom, inscriptions are rarer—both due to the accidents of time and the fact that the earlier Egyptian was less literate than his descendants—and no further observations of the reappearance of Sothis have happened to survive.

There are, however, other records which show that the civil calendar was shifting consistently at least as far back as 2350 B.C.[45] Meyer showed that the flax harvest in the Twelfth Dynasty, about the year 1940 B.C., took place at the appropriate calendrical date in the wandering year.[46] Furthermore, we know from various in-

Month of *Shōmu*, Day 28. This is 19 days later than the date given in the Ebers Papyrus calendar (see next note), and hence there must have been an interval of about $4 \times 19 = 76$ years between the two calendars.

[42] Sethe, *op. cit.*, p. 44; *Zeitrechnung*, p. 313; Meyer, *Nachtr.*, p. 7; Edgerton, *Amer. Jour. of Semitic Languages*, LIII (1937), pp. 195 ff., where the calendar is dated to 1536 B.C. The calendar is for the 9th year of Amen-ḥotpe I when the reappearance of Sothis took place on the 3rd Month of *Shōmu*, Day 9.

[43] Borchardt, *Zeitschrift für ägypt. Sprache*, XXXVII (1899), p. 99; Meyer, *Chron.*, pp. 51 ff. Scharff (*Ältesten Datums*, pp. 19, 21, 31) seems to believe that observations of Sothis began only at about this time.

[44] They tabulate the stars and constellations as they rose on each of the twelve hours of the night, at intervals of ten days, disregarding—probably for simplicity's sake—the five intercalary days at the end of the year. Four coffins from Asyūt (Chassinat and Palanque, *Fouilles dans la Nécropole d'Assiout*, p. 127, pl. XXV, and p. 196; Lacau, *Sarcophages antérieurs au nouvel Empire*, II, p. 107; *cf.* Sethe, p. 306, n. 3, and p. 43, n. 1) and one from Thebes (published only in a preliminary report by Winlock, *Bulletin of The Metropolitan Museum of Art*, Nov., 1921, Part II, p. 50, fig. 24) set the reappearance of Sothis in the XII hour of the night between the 171st and 180th days of the year. A fifth (Chassinat and Palanque, *op. cit.*, pp. 117–118) is of the same type but only goes to the 160th day. A sixth coffin (from Asyūt; Chassinat and Palanque, *op. cit.*, p. 145) sets the reappearance between the 181st and 190th days. The situation shown in the first group of coffins was such as existed from 2101 to 2061 B.C., when Egypt was reunited by Neb-ḥepet-Rē' Mentu-ḥotpe. That shown in the last-mentioned coffin is the condition as it existed between 2061 and 2021 B.C. These are dates in the XI Dyn., agreeing very well indeed with our knowledge of Egyptian history and archaeology. They, furthermore, show that these Middle Kingdom dekan tables were kept up to date by periodic corrections.

[45] Often we can not be certain of the exact nature of acts described in documents bearing calendrical dates, and therefore cannot use them in controlling the seasons described. Thus, builders' marks from Lisht (Lansing, *M.M.A. Bulletin*, April, 1933, II, pp. 5–8; November, 1933, II, p. 6) are dated between March and September, but they do not define the operations recorded sufficiently to be used as a check on the calendar of the period.

[46] Meyer, *Nachtr.*, pp. 18 ff.

scriptions that the quarrying season was from January through March in the Twelfth Dynasty, or in terms of the contemporary calendar from the 2nd Month of *Akhet* to the 1st Month of *Prōyet*. In the Sixth Dynasty, when quarrying must have been done at the same season, the corresponding calendar dates were from the 2nd Month of *Shōmu* to the 1st Month of *Akhet*, showing that a shift of about 125 days had taken place in the Egyptian calendar in the five centuries between about 1850 and 2350 B.C.[47]

At each of these several dates the calendar was at variance with the true seasons and with Sothis by about one day for every four years which had elapsed since 2773 B.C. The conclusion is—it seems to me—inescapable that in 2773 B.C. the calendar had been in agreement with the star, and in that year the observations on which this relation had depended were discontinued. The date is astronomically fixed as the start of the wandering calendar of succeeding centuries. We have not, however, sufficient knowledge to do more than guess at what was the historic occasion for this all important change.

In all probability Djoser founded the Third Dynasty about 2778 B.C.,[48] with the famous sage I-em-ḥotpe as his vizier, and Egypt entered upon one of its most flourishing periods under an all-powerful, centralized government.[49] Doubtless the census takers, the tax collectors, and the hosts of royal scribes who were now managing the land found highly unsatisfactory a year whose beginning depended on the chances of an observation of a star in the dawn. The experience of centuries by now had seemed to show that the year should contain 365 days, and this definite figure was adopted for administrative purposes.

But in terms of this new "civil" year the heliacal rising of Sothis gradually came later by a day every four years, until, about a century or so after Djoser's reign, the inscriptions in the Old Kingdom maṣṭabahs call for offerings on two separate New Year Days—*Wepy-ronpet*, "the Opener of the Year," and *Tepy-ronpet*,

[47] Meyer (*Chron.*, pp. 179 ff.) compared these dates when his chronology placed the mean date of the VI Dyn. at 2500 B.C. and concluded that there was a difference in the quarrying season in the two periods. In the above calculation I have used 2350 B.C. as the mean date of the VI Dyn., following his *Ältere Chron.*, p. 68, and the quarrying season of the two periods becomes identical.

[48] Meyer, *Ältere Chron.*, p. 68. In *Geschichte*, § 231, he credits Djoser with a reign of 19 years.

[49] Scharff (*Grundzüge*, p. 57; *Ältesten Datums*, p. 18) believes that the 365 day calendar was invented at this time.

"the First of the Year." [50] The first of these festivals, in Twelfth Dynasty calendars, is also "the Coming Forth of Sothis"; the second festival in all likelihood was the New Year invented for the calendar when it became definitely and obviously separated from nature.

In the meantime, it must not be forgotten that the date of the first appearance of the Nile flood fluctuates between very wide limits, and for several generations after the fixing of the calendar in 2773 B.C. the "civil" year would still have been, to all appearances, as closely related to the flood as ever. By the time that the flood always fell outside of the calendrical "Flood Season"—*Akhet*—the "civil" calendar had been so long established that no one had the temerity to do anything about it. It was perhaps at this time, while the "civil" calendar was becoming less and less dependable in foretelling the true seasons, that the conservative priesthood invented the coronation oath which called for the new king to swear—as we are informed—"never to intercalate a month or a day nor to vary a festival but to preserve the 365 days as they were ordained of old." [51]

And so for the next three thousand years the Egyptian obstinately refused to follow a fixed calendar, until he adopted the Alexandrian year with Christianity—and to this latter year the Coptic priest still adheres as uncompromisingly as his ancestors followed the ancient calendar.

In conclusion, it is my belief that his calendar was not an invention made by the Egyptian on any one day at dawn, when a series of phenomena happened to coincide. On the contrary, it was a gradually developed method of predicting approximately the almost unpredictable rise of the Nile. For a few centuries before 2773 B.C. it depended on the observation of the reappearance of Sirius, and the resulting self-adjusting year was as true a measure

[50] Meyer, *Chron.*, pp. 36, 40; Sethe, p. 303. Scharff (*Ältesten Datums*, pp. 16 and 19, note 2) seems to be sceptical of this theory of Meyer's; firstly, because in New Kingdom inscriptions the Egyptian himself confused the two festival names; and secondly, because his own theory denies the existence of a Sothic year in the Old Kingdom.

[51] So far as I am aware, we do not know of this oath before its mention by P. Nigidius Figulus of the 1st Cent. B.C. (Sethe, p. 310; Meyer, *Chron.*, p. 31), but it unquestionably goes back to some period when there was a lively memory of such attempts and a reasonable fear of their repetition. No office holder is ever called upon to abjure a crime which has never been invented. Of course, this oath might have been inspired by the attempted reform of Ptolemy III in the III Cent. B.C., but it is unlikely that such an oath could have been wrung from a king in so enlightened a period.

of solar time as was the much later Julian year. However, as man became more civilized he felt the need of some method of time reckoning more definite than nature itself. In 2773 B.C. he dropped his New Year's observations and took up the 365 day year, which actually brought his seasons back into their original places only once again during his whole history.